

§ 25.1326

(e) Each system must be designed and installed so that the error in indicated pressure altitude, at sea level, with a standard atmosphere, excluding instrument calibration error, does not result in an error of more than ± 30 feet per 100 knots speed for the appropriate configuration in the speed range between $1.3 V_{SO}$ with flaps extended and $1.8 V_{SI}$ with flaps retracted. However, the error need not be less than ± 30 feet.

(f) If an altimeter system is fitted with a device that provides corrections to the altimeter indication, the device must be designed and installed in such manner that it can be bypassed when it malfunctions, unless an alternate altimeter system is provided. Each correction device must be fitted with a means for indicating the occurrence of reasonably probable malfunctions, including power failure, to the flight crew. The indicating means must be effective for any cockpit lighting condition likely to occur.

(g) Except as provided in paragraph (h) of this section, if the static pressure system incorporates both a primary and an alternate static pressure source, the means for selecting one or the other source must be designed so that—

(1) When either source is selected, the other is blocked off; and

(2) Both sources cannot be blocked off simultaneously.

(h) For unpressurized airplanes, paragraph (g)(1) of this section does not apply if it can be demonstrated that the static pressure system calibration, when either static pressure source is selected, is not changed by the other static pressure source being open or blocked.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-5, 30 FR 8261, June 29, 1965; Amdt. 25-12, 32 FR 7587, May 24, 1967; Amdt. 25-41, 42 FR 36970, July 18, 1977]

§ 25.1326 Pitot heat indication systems.

If a flight instrument pitot heating system is installed, an indication system must be provided to indicate to the flight crew when that pitot heating system is not operating. The indication system must comply with the following requirements:

(a) The indication provided must incorporate an amber light that is in clear view of a flight crewmember.

(b) The indication provided must be designed to alert the flight crew if either of the following conditions exist:

(1) The pitot heating system is switched “off”.

(2) The pitot heating system is switched “on” and any pitot tube heating element is inoperative.

[Amdt. 25-43, 43 FR 10339, Mar. 13, 1978]

§ 25.1327 Magnetic direction indicator.

(a) Each magnetic direction indicator must be installed so that its accuracy is not excessively affected by the airplane’s vibration or magnetic fields.

(b) The compensated installation may not have a deviation, in level flight, greater than 10 degrees on any heading.

§ 25.1329 Automatic pilot system.

(a) Each automatic pilot system must be approved and must be designed so that the automatic pilot can be quickly and positively disengaged by the pilots to prevent it from interfering with their control of the airplane.

(b) Unless there is automatic synchronization, each system must have a means to readily indicate to the pilot the alignment of the actuating device in relation to the control system it operates.

(c) Each manually operated control for the system must be readily accessible to the pilots.

(d) Quick release (emergency) controls must be on both control wheels, on the side of each wheel opposite the throttles.

(e) Attitude controls must operate in the plane and sense of motion specified in §§ 25.777(b) and 25.779(a) for cockpit controls. The direction of motion must be plainly indicated on, or adjacent to, each control.

(f) The system must be designed and adjusted so that, within the range of adjustment available to the human pilot, it cannot produce hazardous loads on the airplane, or create hazardous deviations in the flight path, under any condition of flight appropriate to its use, either during normal

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operation or in the event of a malfunction, assuming that corrective action begins within a reasonable period of time.

(g) If the automatic pilot integrates signals from auxiliary controls or furnishes signals for operation of other equipment, there must be positive interlocks and sequencing of engagement to prevent improper operation. Protection against adverse interaction of integrated components, resulting from a malfunction, is also required.

(h) If the automatic pilot system can be coupled to airborne navigation equipment, means must be provided to indicate to the flight crew the current mode of operation. Selector switch position is not acceptable as a means of indication.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-46, 43 FR 50598, Oct. 30, 1978]

§ 25.1331 Instruments using a power supply.

(a) For each instrument required by § 25.1303(b) that uses a power supply, the following apply:

(1) Each instrument must have a visual means integral with, the instrument, to indicate when power adequate to sustain proper instrument performance is not being supplied. The power must be measured at or near the point where it enters the instruments. For electric instruments, the power is considered to be adequate when the voltage is within approved limits.

(2) Each instrument must, in the event of the failure of one power source, be supplied by another power source. This may be accomplished automatically or by manual means.

(3) If an instrument presenting navigation data receives information from sources external to that instrument and loss of that information would render the presented data unreliable, the instrument must incorporate a visual means to warn the crew, when such loss of information occurs, that the presented data should not be relied upon.

(b) As used in this section, "instrument" includes devices that are physically contained in one unit, and devices that are composed of two or more physically separate units or compo-

nents connected together (such as a remote indicating gyroscopic direction indicator that includes a magnetic sensing element, a gyroscopic unit, an amplifier and an indicator connected together).

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-41, 42 FR 36970, July 18, 1977]

§ 25.1333 Instrument systems.

For systems that operate the instruments required by § 25.1303(b) which are located at each pilot's station—

(a) Means must be provided to connect the required instruments at the first pilot's station to operating systems which are independent of the operating systems at other flight crew stations, or other equipment;

(b) The equipment, systems, and installations must be designed so that one display of the information essential to the safety of flight which is provided by the instruments, including attitude, direction, airspeed, and altitude will remain available to the pilots, without additional crewmember action, after any single failure or combination of failures that is not shown to be extremely improbable; and

(c) Additional instruments, systems, or equipment may not be connected to the operating systems for the required instruments, unless provisions are made to ensure the continued normal functioning of the required instruments in the event of any malfunction of the additional instruments, systems, or equipment which is not shown to be extremely improbable.

[Amdt. 25-23, 35 FR 5679, Apr. 8, 1970, as amended by Amdt. 25-41, 42 FR 36970, July 18, 1977]

§ 25.1335 Flight director systems.

If a flight director system is installed, means must be provided to indicate to the flight crew its current mode of operation. Selector switch position is not acceptable as a means of indication.

[Amdt. 25-41, 42 FR 36970, July 18, 1977]

§ 25.1337 Powerplant instruments.

(a) *Instruments and instrument lines.*

(1) Each powerplant and auxiliary